

## **PCT**

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#### Published

With international search report.

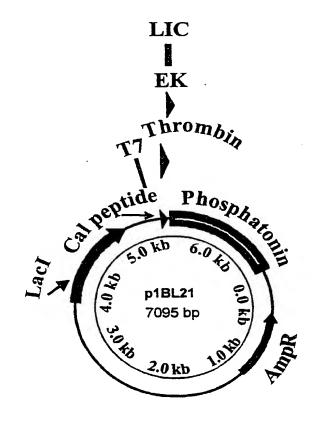
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(88) Date of publication of the international search report:
9 March 2000 (09.03.00)

(54) Title: HUMAN TUMOUR-DERIVED POLYPEPTIDE HORMONE PHOSPHATONIN

#### (57) Abstract

The present invention relates to a novel human protein called phosphatonin, and isolated polynucleotides encoding this protein. Also provided are vectors, host cells, antibodies, and recombinant methods for producing this human protein. The invention further relates to diagnostic and therapeutic methods useful for diagnosing and treating disorders related to this novel human protein.



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Internation. plication No PCT/EP 99/03403

A. CLASSIFICATION OF SUBJECT MATTER
1PC 6 C12N15/16 C07K14/575 A61K38/22 G01N33/68 C12Q1/68 According to International Patent Classification (IPC) or to both national classification and IPC **B. FIELDS SEARCHED** Minimum documentation searched (classification system followed by classification symbols) CO7K C12N A61K G01N C12Q IPC 6 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practical, search terms used) C. DOCUMENTS CONSIDERED TO BE RELEVANT Category ° Citation of document, with indication, where appropriate, of the relevant passages Relevant to claim No. Χ ROWE P S N ET AL.: "Candidate 56 and 58 1-4,6,7, kDa protein(s) responsible for mediating 14-20. the renal defects in oncogenic 26-28,31 hypophosphatemic osteomalacia" BONE, vol. 18, no. 2, February 1996 (1996-02), pages 159-169, XP000856897 cited in the application the whole document X WO 95 14772 A (MATSUBARA KENICHI ;OKUBO 8-13,21, KOUSAKU (JP)) 1 June 1995 (1995-06-01) 31-33 see SEQ ID NO: 4634 (page 1417) abstract; claims 1-6 & EP 0 679 716 A (MATSUBARA KENICHI; OKUBO KOUSAKU (JP)) 2 November 1995 (1995-11-02) see SEQ ID NO: 4634 (page 1391) abstract; claims 1-6 -/--X Further documents are listed in the continuation of box C. Patent family members are listed in annex. Special categories of cited documents: "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the \*A\* document defining the general state of the art which is not considered to be of particular relevance invention "E" earlier document but published on or after the international "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone filing date "L" document which may throw doubts on priority claim(a) or which is cited to establish the publication date of another citation or other special reason (as specified) "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such document. "O" document referring to an oral disclosure, use, exhibition or ments, such combination being obvious to a person skilled "P" document published prior to the international filing date but later than the priority date claimed "&" document member of the same patent family Date of the actual completion of the international search Date of mailing of the international search report **1 1.** 01. 00 22 December 1999 Name and mailing address of the ISA Authorized officer European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Oderwald, H Fax: (+31-70) 340-3016

Form PCT/ISA/210 (second sheet) (July 1992)

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# INTERNAL SEARCH REPORT

Internatio: pplication No PCT/EP 99/03403

C/C==4!=	Nine) DOCUMENTS CONCINCING TO BE SEEN	PC1/EP 99/03403
Category °	ation) DOCUMENTS CONSIDERED TO BE RELEVANT  Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
		neievan to dam No.
	ROWE P S N: "The PEX gene: its role in X-linked rickets, osteomalacia, and bone mineral metabolism" EXPERIMENTAL NEPHROLOGY, vol. 5, 1997, pages 355-363, XP000862824 cited in the application the whole document	40
	LINDE A AND GOLDBERG M: "Dentinogenesis" CRITICAL REVIEWS IN ORAL BIOLOGY AND MEDICINE., vol. 4, no. 5, 1993, pages 679-728, XP000862825 ISSN: 1045-4411 cited in the application the whole document	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

#### **INTERNATIONAL SEARCH REPORT**

Internat. .al application No. PCT/EP 99/03403

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first heet)
This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:
Claims Nos.: because they relate to subject matter not required to be searched by this Authority, namely:
Although claims 24 and 40 are directed to a method of treatment of the human/animal body, the search has been carried out and based on the alleged effects of the compound/composition.
2. X Claims Nos.:  Claims Nos.:  Secure they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:  See FURTHER INFORMATION sheet PCT/ISA/210
3. Claims Nos.: because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).
Box il Observations where unity of invention is lacking (Continuation of item 2 of first sheet)
This International Searching Authority found multiple inventions in this international application, as follows:
As all required additional search fees were timely paid by the applicant, this International Search Report covers all
searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
Remark on Protest  The additional search fees were accompanied by the applicant's protest.  No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box I.2

Claims Nos.: 30

Claims 30-39 refer to activators and inhibitors of the polypeptide without giving a true technical characterization. Moreover, no such compounds are defined in the application. In consequence, the scope of said claims is ambiguous and vague, and their subject-matter is not sufficiently disclosed and supported (Art. 5 and 6 PCT). No search can be carried out for these compounds of such purely speculative claims whose wording is, in fact, a mere recitation of the results to be achieved.

The applicant's attention is drawn to the fact that claims, or parts of claims, relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure.

Information on patent family members

Internation plication No PCT/EP 99/03403

Patent document		Publication	Patent family		Publication date	
cited in search report		date	member(s)			
WO 9514772	A	01-06-1995	AU CA EP	8116494 A 2153480 A 0679716 A	13-06-1995 01-06-1995 02-11-1995	

## PATENT COOPERATION TREATY

FEC'D 08 SEP 2000





# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

	gent's file reference	FOR FURTHER AC		ication of Transmittal of International ry Examination Report (Form PCT/IPEA/416)		
D 1583 PCT						
International ap	plication No.	International filing date (d	lay/month/year)	Priority date (day/month/year)		
PCT/EP99/0		18/05/1999		18/05/1998		
International Pa C12N15/16	atent Classification (IPC) or na	tional classification and IPC	•			
Applicant	Y COLLEGE LONDON					
UNIVERSIT	T COLLEGE LONDON					
	rnational preliminary exam ansmitted to the applicant a		prepared by this In	ternational Preliminary Examining Authority		
2. This REF	PORT consists of a total of	9 sheets, including this	cover sheet.			
beer	report is also accompanie n amended and are the ba Rule 70.16 and Section 6	sis for this report and/or	sheets containing	ion, claims and/or drawings which have rectifications made before this Authority the PCT).		
These a	These annexes consist of a total of 7 sheets.					
3. This repo	ort contains indications rela	ating to the following iter	ns:			
1 (	Basis of the report					
II Priority						
111 (	Non-establishment of c	pinion with regard to no	velty, inventive ste	p and industrial applicability		
_	Lack of unity of inventi					
V 1		nder Article 35(2) with roons suporting such state		ventive step or industrial applicability;		
VI (	☐ Certain documents cit	ed				
VII   Certain defects in the i		international application				
VIII	VIII   Certain observations on the international application					
Date of submission of the demand			Date of completion	of this report		
01/12/1999						
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))) <sup>[</sup>	uropean Patent Office -80298 Munich el. +49 89 2399 - 0 Tx: 52365	6 epmu d	Pilat, D	(Aug - Aug -		
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# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/EP99/03403

I. E	Basis	of th	r	port
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1.	resp	This report has been drawn on the basis of (substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.):						
	Des	Description, pages:						
	1-97	7	as originally filed					
	Clai	ims, No.:						
	1-40	)	as received on	14/08/2000	with letter of	10/08/2000		
	Dra	wings, sheets:						
	1/17	7-17/17	as originally filed					
2.	The	amendments hav	e resulted in the cancellat	ion of:				
		the description,	pages:					
		the claims,	Nos.:					
		the drawings,	sheets:					
3.		This report has be considered to go	een established as if (son beyond the disclosure as	ne of) the amendmer filed (Rule 70.2(c)):	nts had not been	made, since they have be	en	
4.	Add	ditional observation	ns, if necessary:					
111	. Noi	n-establishment d	of opinion with regard to	novelty, inventive	step and indust	trial applicability		
Tł or	ne qu to b	restions whether the industrially application	ne claimed invention appe cable have not been exan	ears to be novel, to in nined in respect of:	nvolve an inventiv	ve step (to be non-obvious	),	
		the entire interna	itional application.					
	$\boxtimes$	claims Nos. 21,2	2,23-25,29.					
be	ecau	se:						

#### INTERNATIONAL PRELIMINARY **EXAMINATION REPORT**

International application No. PCT/EP99/03403

×	the said international application, or the said claims Nos. 23-25 relate to the following subject matter which does not require an international preliminary examination ( <i>specify</i> ):
	see separate sheet
⊠	the description, claims or drawings ( <i>indicate particular elements below</i> ) or said claims Nos. 21,22 are so unclear that no meaningful opinion could be formed ( <i>specify</i> ):
	see separate sheet
	the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion

- V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- 1. Statement

Novelty (N)

Yes:

no international search report has been established for the said claims Nos. 29.

Claims 7-12,13,14,20,23-28,30-39

No:

Claims 1-6.15-19.40

Inventive step (IS)

Yes: No:

Claims 13

Claims 7-12,14,20,23-28,30-39

Industrial applicability (IA)

Yes:

Claims 1-20,26-28,30-40

Claims No:

2. Citations and explanations

see separate sheet

#### VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

## **EXAMINATION REPORT - SEPARATE SHEET**

#### Ad Section I: Basis of the report

Reference is made to the following documents:

- D1: ROWE P S N ET AL.: 'Candidate 56 and 58 kDa protein(s) responsible for mediating the renal defects in oncogenic hypophosphatemic osteomalacia' BONE, vol. 18, no. 2, February 1996 (1996-02), pages 159-169, XP000856897 cited in the application
- D2: WO 95 14772 A (MATSUBARA KENICHI ;OKUBO KOUSAKU (JP)) 1 June 1995 (1995-06-01) & EP 0 679 716 A (MATSUBARA KENICHI; OKUBO KOUSAKU (JP)) 2 November 1995 (1995-11-02)
- D3: ROWE PS N: 'The PEX gene: its role in X-linked rickets, osteomalacia, and bone mineral metabolism' EXPERIMENTAL NEPHROLOGY, vol. 5, 1997, pages 355-363, XP000862824 cited in the application

#### Amendments (Article 33 (3) PCT) 1.

The new set of claims submitted with the applicant's letters on the 10th of August 2000 appears to be admissible.

#### Ad Section III :Non-establishment of opinion

#### 2. Clarity and Support (Article 6 PCT)

Claims 21 and 22 refer to a regulatory sequence of a promoter. However, this regulatory sequence is not characterized by its essential features. At present this regulatory sequence is entirely undefined. Moreover, in the absence of any disclosure of such a sequence the claimed subject-matter is speculative. Thus, claims 21 and 22 lack clarity and support.

#### Industrial applicability (Article 33 (4) PCT) 3.

For the assessment of the present claims 23-25 on the question whether they are industrially applicable, no unified criteria exist in the PCT. The patentability can

also be dependent upon the formulation of the claims. The EPO, for example, does not recognize as industrially applicable the subject-matter of claims to the use of a compound in medical treatment or in diagnostic methods, but may allow, however, claims to a known compound for first use in medical treatment or diagnostic method and the use of such a compound for the manufacture of a medicament for a new medical treatment.

Claims 23-25 relate to subject-matter considered by this Authority to be covered by the provisions of Rule 67.1(iv) PCT. Consequently, no opinion will be formulated with respect to the industrial applicability of the subject-matter of these claims (Article 34(4)(a)(i) PCT).

## Ad Section V: Reasoned statement under Rule 66.2(a)(ii); citations and explanations supporting such statement

- Novelty (Article 33 (2) PCT) 4.
- D1 describes candidate protein(s) having "phosphatonin" activity and having a MW of approximately 56 and 58 kDa and antibodies binding specifically said candidate protein(s). The molecular weights were determined on a western blot using a preoperative antiserum (see abstract and Fig. 7). In view of D1, claim 1, referring to a polypeptide having phosphatonin activity and an approximate MW of 60 kDa, and claims 2-6, 15-19 lack novelty (see also point 4.1 below)
- 4.2 D2 describes a polynucleotide SEQ ID N°4634 (see p.1391) having 97,5% identity over 121 bp with the claimed SEQ ID N°1. However, said fragment resides in the untranslated region and therefore does not encode a polypeptide or a fragment thereof which is capable of regulating phosphate metabolism. Thus, claims 7-12 seems novel (see also point 5.1 below)
- 4.3 Because the process of transforming does not provide any new features to the claimed cell lines compared to prior art cell lines and the overexpression is a relative term, any prior art use of an osteoblast or bone cell line anticipates claim 40.
- Inventive step (Article 33 (3) PCT) 5.

- 5.1 Document D1 is considered to represent the most relevant state of the art. It discloses candidate protein(s) responsible for mediating the renal defect in Oncogenic Hypophosphatemic Osteomalacia (OHO) from which the subject-matter of claim 7 differs only in that it provides the polynucleotide sequence. The problem to be solved by the present invention may therefore be regarded as to obtain the polynucleotide sequence encoding said candidate protein(s). In order to solve the problem posed, the skilled person would have used the teaching of D1 (e.g. the preoperative antiserum) and standard molecular biology techniques and consequently would had arrived at the claimed subject-matter of claim 7 (see also D1 p.167 col.2 lines 13-19). Thus, the solution proposed in this claim lacks an inventive step.
- 5.2 The same objection of lack of inventive step applies mutatis mutandis to the subject-matter of claims 8-12, 14, 20, 30-32 which refer to expression vectors, to compositions, to processes of producing a polypeptide.
- 5.3 A process for obtaining tumor-conditioned media is described in D1 (see p.161 col.1 "Tissue culture...", furthermore the step of purifying the candidate protein(s) having a phosphatonin activity using immunoaffinity techniques is also suggested (see p.167 lines col.2 13-19).

  However, new claim 13 comprises an ion-exchange chromatography. Based on D1 and general knowledged, the skilled person, looking for an alternative method of D1, would not have tried to isolate phosphatonin using a process as claimed in claim 13 with a reasonable expectation of success. Thus, claim 13 seems to involve an inventive step.
- 5.4 Methods of treatment of medical conditions that are related to disorders of phosphate metabolism, methods of diagnosing a pathological condition, method for identifying a binding partner and use of polypeptides or polynucleotides or antibodies specifically recognizing said candidate protein(s) as a medicament are known in the art. Similarly, the polypeptide claimed in claims 1 to 6 and the polynucleotides in claim 7 are either not new or not inventive.

  Moreover, the candidate protein(s) identified are known to be involved in hypophosphatemia, in particular in OHO which is linked with a bone mineral loss (osteomalacia). Consequently, a mere use of these methods and said

polypeptides is obvious in the light of the teaching of D1. Thus, claims 23-28 and 33-38 are trivial.

5.5 D1 describes candidate protein(s) that are responsible for mediating the renal defects in OHO. D3 speculates that said candidate protein(s) may be unprocessed and the result of an defective proteolytic processing mediated by PHEX (see p.359 col.2 lines 40-51 to p.360 col.1 line 8). Thus, the skilled person, looking for an composition capable of treating OHO, would have combined the polypeptide of present claim 7 and PHEX in a preparation without any inventive activity. Therefore, claim 39 lacks an inventive step.

Ad Section VIII: Certain observations on the international application.

#### 6. Clarity (Article 6 PCT)

- 6.1 Claim 1 attempts to define the "polypeptide" by means of a result to be achieved, i.e. "having a phosphatonin activity", which merely amounts to a statement of the underlying problem. The technical features necessary for achieving this result should be added. At present, it cannot be assessed whether known products in the art falls under the scope of protection of these claims or not. The addition of an approximate molecular weight does not allow a third party to reliably distinguish the claimed compound from prior art compounds. Thus, the scope of protection of these claims is vague and indefinite.
- 6.2 Claims 1-3 refer to a compound which is characterized by a "phosphatonin" function (whatever this means?) and a molecular weight using different experimental conditions.
  - It is emphasized that a claim may be characterized solely by its parameters only in exceptional cases (see PCT Guidelines C-III, 4.7a).
  - This wording should be allowable where the invention cannot be **adequately** defined in any other way, provided these parameters can be clearly and reliably determined. They should not be trivial or additional parameters not measured for prior art compound(s). In this context, the protein may be identified by means of its amino acid sequence. Thus, the molecular weight cannot be considered as defining sufficiently said polypeptide. Thus, claims 1-3 lack clarity. The same

objection remains valid for claims 16-18.

- 6.3 Claim 4 refers to an polypeptide which is "obtainable" from a particular cell line.

  This product cannot be distinguished from the prior art polypeptide obtained from another source, because the mere origin does not confer to said product any distinguishing feature.
  - The same objection and rationale applies to the wording "encodable" of claim 5. The same objection applies to claim 15 as well.
- 6.4 Claim 5 refers to a "immunologically or biologically active fragment". Any fragment having a certain length and a biological activity (e.g. epitope or binding activity) falls under the scope of protection of this claim.
- 6.5 Claim 5c lacks clarity, since the term "derived" is vague and indefinite. The applicant should define in the claims what is understood by said term. A polypeptide having a phosphatonin activity and being "derived" by ways of mutations is not clear. It encompasses any prior art protein having a similar activity, the sequence being of no relevance.
- 6.6 Claim 5d refers to a polynucleotide comprising the complementary strand which to hybridize to any polynucleotide as defined in a) to c).

  Since, the polynucleotide claimed in point c) and the hybridization conditions are not identified in the claim, the claimed subject-matter is indefinite (see point 6.5 above).
- 6.7 Claim 5e refers to a polynucleotide encoding a polypeptide sequence which has a 60% identity to a amino acid encoded by a polynucleotide defined in claims 5c), d). Since the polynucleotide of claims 5c) d) are undefined (see points 6.5 and 6.6, the amino acid encoded by these polynucleotide is undefined as well. Ultimately, the polynucleotide encoding a polypeptide which is 60% identical to a undefined polypeptide lacks clarity.
- 6.8 Claim 5f is unclear insofar as the polynucleotides encoding the polypeptides identified in claims 5 c)to d) are unclear. The same objection applies to item 5h)-j). Due to the wording used claim 5 c)g)h)i)j) is anticipated by prior art polypeptides.

For example, the present description states that the MEPE C-terminal region (414-427) shares 80% to a recurring motif found in DPP as well as two related sequences found in DSP at position 576-589 ad 800-813. Another sequence homology as been found which shares homology to DMA-1 at residues 408-429 (see present description p.78 and Fig.12, Table II). These proteins must be considered as derivatives or as proteins encoded by a polynucleotide which hybridizes to the C-terminal part of MEPE and as proteins which share at least one epitope bearing portion with MEPE.

In addition any prior art with an "phosphatonin activity" (whatever this means?) having an unrelated epitope bearing portion which originates from the 40% unrelated amino acid sequence of item e) or from the non-hybridizing part of the polynucleotide of item d) or the unrelated added part of item c) anticipates the claimed subject-matter.

- 6.9 Claim 6 refers to a polypeptide which is capable of regulating phosphate metabolism. As already objected to in point 6.2 above, the product must be adequately and unequivocally defined by these parameters and they should be sufficient to reliably distinguish the claimed compound from the prior art compounds, so that a third party may determine without any doubt for which compound protection is actually sought. The parameters employed should not be merely additional parameters which were not measured for prior art compound(s) (e.g. a functional requirement). As such claim 6 lacks clarity.
- 6.10 Claim 10 is obscure because the hybridizing conditions are not defined and because the subject-matter encompass product which have no function anymore. It is reminded that negative features may only be used if the subject-matter cannot be defined more clearly and concisely by means of positive features (see PCT Guidelines C-III 4.12). The same objection is applicable to claim 18.

# F ENT COOPERATION TREA

	From the INTERNATIONAL BUREAU			
PCT	То:			
NOTIFICATION OF ELECTION  (PCT Rule 61.2)	Assistant Commissioner for Patents United States Patent and Trademark Office Box PCT Washington, D.C.20231 ÉTATS-UNIS D'AMÉRIQUE			
Date of mailing (day/month/year) 07 January 2000 (07.01.00)	in its capacity as elected Office			
International application No. PCT/EP99/03403	Applicant's or agent's file reference D 1583 PCT			
International filing date (day/month/year) 18 May 1999 (18.05.99)	Priority date (day/month/year) 18 May 1998 (18.05.98)			
Applicant ROWE, Peter				
1. The designated Office is hereby notified of its election made:    X   in the demand filed with the International Preliminary Examining Authority on:   01 December 1999 (01.12.99)   in a notice effecting later election filed with the International Bureau on:   2. The election   X   was   was not   was not   was not   made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).				
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer  Jean-Marie McAdams			
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38			